

Preface

The Department of the Interior (DOI) Adaptive Management Working Group sponsored the development of this applications guide to provide, through examples, a better understanding of how adaptive management can be implemented in the field. The applications guide builds on the framework for adaptive management presented in the DOI Adaptive Management Technical Guide, and illustrates the elements of adaptive management with a large number of natural resource examples.

The Adaptive Management Working Group includes representatives from most DOI bureaus and offices. Writing teams of resource managers, technical experts, and other specialists worked with the group to identify and describe applications of adaptive management in four thematic areas: climate change, water resources, energy resources, and the interface of human and natural systems. These themes were chosen to illustrate the elements and processes of adaptive management because of their importance to DOI management responsibilities, the current interest in the thematic areas in using adaptive management, and the broad potential in each thematic area for learning-based management.

In writing this guide, we attempted to provide enough background about the elements of adaptive management implementation, and the challenges in implementing it, to give the reader a context for the resource examples. We also sought to provide enough detail in the examples to illustrate clearly the elements of adaptive management. Thus, the guide includes summaries of the principles and issues relevant to adaptive management, followed by descriptions of potential and actual applications in each of the four thematic areas. The intention was to provide enough detail about the actual process of adaptive management to be informative, while limiting the scope, complexity, and size of the document.

We thank the many collaborators who designed and implemented the example projects in this guide. In addition to the contributing authors, they include: Larissa Bailey, Scott Boomer, Willard Bowers, David Breininger, Martha Brookes, Pat Cunningham, Michael Conroy, Scott Conroy, Stan Cook, Robyn Darbyshire, Brean Duncan, Bridgette Flanders-Wanner, Byron J. Freeman, Mary C. Freeman, Jim Furnish, Jill Gannon, Lauren E. Hay, Richard Haynes, Katie Kennedy, Eric Lonsdorf, Jon Martin, Brady Mattson, Andrew McClung, Kate O'Brien, Allan O'Connell, Nancy Pau, Jim Peterson, Michelle Reynolds, Michael Runge, Stacy Salvevold, Terry Shaffer, Karen Simms, Ted Simons, David R. Smith, Lori Stevenson, and Paul Thomas.

Drafts of the guide were reviewed multiple times by a large number of biologists, natural resource specialists, and managers, including staff in the DOI agencies. Each round of reviews resulted in an updated draft version of the document. Design, layout, and production of the final document were supported by the U.S. Geological Survey and the Office of Policy Analysis under the Assistant Secretary – Policy, Management, and Budget.

Contents

| | |
|--|-----------|
| Preface..... | i |
| Executive Summary..... | v |
| CHAPTER 1: INTRODUCTION..... | 1 |
| CHAPTER 2: FRAMEWORK OF ADAPTIVE MANAGEMENT..... | 5 |
| 2.1. Learning-based natural resource management..... | 5 |
| 2.2. Natural resource context for adaptive management..... | 6 |
| 2.3. Adaptive decision making defined..... | 9 |
| 2.4. Conditions warranting the use of adaptive management..... | 11 |
| 2.5. Set-up phase of adaptive management..... | 12 |
| 2.6. Iterative phase of adaptive management..... | 15 |
| 2.7. Institutional learning..... | 16 |
| CHAPTER 3: IMPLEMENTATION ISSUES | 19 |
| 3.1. Geographic scale..... | 19 |
| 3.2. Surprise, resilience, and flexibility..... | 20 |
| 3.3. Evaluating adaptive management..... | 22 |
| 3.4. Impediments and alternatives to adaptive management..... | 26 |
| 3.5. Organizations and adaptive learning..... | 29 |
| 3.6. Statutory and regulatory considerations..... | 31 |
| CHAPTER 4: UNCERTAINTY AND LEARNING | 37 |
| 4.1. Components of uncertainty..... | 37 |
| 4.2. Systemic resource changes over time..... | 41 |
| 4.3. Models, management alternatives, and learning..... | 42 |
| 4.4. Example: Uncertainty and learning in waterfowl management..... | 44 |
| CHAPTER 5: COMPONENTS OF THE SET-UP PHASE OF ADAPTIVE MANAGEMENT | 49 |
| 5.1. Stakeholder involvement..... | 49 |
| 5.2. Objectives..... | 53 |
| 5.3. Management alternatives..... | 55 |
| 5.4. Predictive models..... | 60 |
| 5.5. Monitoring protocols..... | 64 |
| CHAPTER 6: COMPONENTS OF THE ITERATIVE PHASE OF ADAPTIVE MANAGEMENT | 69 |
| 6.1. Decision making..... | 69 |
| 6.2. Follow-up monitoring..... | 72 |
| 6.3. Assessment..... | 74 |
| 6.4. Learning and feedback..... | 76 |
| 6.5. Institutional learning..... | 78 |

| | |
|--|-----|
| CHAPTER 7: INTEGRATING THE COMPONENTS OF ADAPTIVE MANAGEMENT..... | 83 |
| 7.1. Tallapoosa River – R.L. Harris Dam in Alabama..... | 83 |
| 7.2. Red knots and horseshoe crabs in Delaware Bay..... | 85 |
| 7.3. Southeastern pine forests and red-cockaded woodpeckers..... | 88 |
| 7.4. Golden eagles in Denali National Park..... | 92 |
| CHAPTER 8: FUTURE DIRECTIONS..... | 97 |
| References..... | 102 |
| Appendix: Overviews of Selected Examples..... | 111 |
| Glossary..... | 118 |